Prevalence of Beers Criteria Medications among Elderly Patients in a Tertiary Care Hospital

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ABSTRACT

A prospective observational study was conducted to assess the prescription pattern, polypharmacy and rationality of anti-diabetic drugs in diabetology department of a tertiary care teaching hospital, Trivandrum. During the six months study period, a total of 110 prescriptions from diabetology department were included in this study. Metformin is the preferred drug in monotherapy. Elderly patient with multiple diseases have revealed incidence of poly pharmacy. Health care providers must consider beer's criteria while prescribing drugs to elderly.

INTRODUCTION

Demographic evolution suggests a steady increase in the population aged above 65 years who are called as Geriatrics and they are the most vulnerable and largest consumers of prescription drugs. Co-morbid conditions which leads in the poly pharmacy and drug related issues makes the treatment of geriatrics, a major challenge to the physicians.[1] A holistic, multidisciplinary approach is therefore needed to treat geriatrics. The physiologic changes of aging and potential drug–drug and drug–disease interactions are the common findings seen in elderly patients[2]. The Beers Criteria for the Potentially Inappropriate Medication use in older adults commonly called as Beers list. It is a guideline for health professionals to help improve the safety of prescribing medicines for older adults. It emphasizes on de-prescribing medication that is unnecessary.

Potentially inappropriate medication (PIM) mean ' drug in which the risk of an adverse event is greater than their clinical benefit, especially if safer or more efficient alternative therapy is available for the same condition. The potential inappropriate use of medication in this vulnerable group must be identified so as to minimize pharmacotherapy related hazards.

Geriatrician Mark H. Beers formulated the Beers Criteria through a consensus panel of experts using the Delphi method. The Delphi method is a forecasting process framework based on the results of multiple rounds of questionnaires sent to a panel of experts. Several rounds of questionnaires are sent out to the group of experts, and the anonymous responses are aggregated and shared with the group after each round. The experts are allowed to adjust their answers in subsequent rounds, based on how they interpret the "group response" that has been provided to them.[3]

According to WHO, Diabetes is a chronic metabolic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood sugar.[4] Autoimmune destruction of the β-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action are the major pathogenic process involved in the development of diabetes.[5]

According to international diabetes fereration(IDF), India is one of the 6 countries of the Southeast asia region. 425 million people have diabetes in the world and 82 million people in the SEA Region. There were over 72.946.400 cases of diabetes in India in 2017.[6]

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MATERIALS AND METHODS

A prospective observational study, conducted to find out the utilization pattern of drugs in 60 elderly patients based on beers criteria under the age of 65years. The study was conducted in the diabetology department of SK hospital Trivandrum and it was a 300 bedded multispecialty tertiary care hospital. The objectives of this study were: to evaluate the prescription pattern of drugs in geriatrics and to identify Potentially Inappropriate Medications using Beers Criteria 2012. Descriptive statistics were used for describing the study variables. The study has been carried out for 6 months and it was conducted in 60 elderly patients from diabetology department. The study title and protocol was approved by institutional ethics committee. The subjects were selected on the basis of inclusion and exclusion criteria.

Study criteria:

Inclusion criteria:

- Patients with type 2 diabetes.

- Outpatients who will be prescribed with anti-diabetic drugs under diabetology department.

- Patients with age above 65 years.

- Both males and females.

- Patients with comorbidities and polypharmacy.

Exclusion criteria

- Patients with type 1 diabetes.

- Patients with age below 65years.

- Pregnant women and lactating mothers were excluded.

- Mentally retarded patients were excluded.

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Study procedure: Study design adopted was DUE. A predesigned data collection form was used to collect the prescription details of outpatients of diabetology department. Relevant information like patient demographical details, drug-related information's (dose, frequency, and duration), laboratory investigations, social and family histories, medical histories were collected from case sheet, treatment chart, laboratory reports and through the patient interview.

The revised version 2012 of beers criteria was used in this study and it includes three groups of medication: medications to avoid in older adults regardless of diseases or conditions; medications considered potentially inappropriate when used in older adults with certain diseases or syndromes; and group of medications that should be used with caution in older adults.

RESULTS

A prospective observational study was conducted to assess the prescription pattern, polypharmacy and rationality of anti-diabetic drugs in diabetology department of a tertiary care teaching hospital, Trivandrum. During the six months study period, a total of 110 prescriptions from diabetology department were included in this study.

Based on Gender

Table 1 and figure 1 represents the gender wise distribution of 110 patients from diabetology department prescribed with anti-diabetes. Of these 42 (38.18%) were males and 68 (61.81%) were female patients.

Table No. 1: Gender Wise Distribution of Prescription

SL. No.	Gender	No. of prescriptions (n=110)	Percentage (%)
1.	Male	42	38.18
2.	**Female**	**68**	**61.81**

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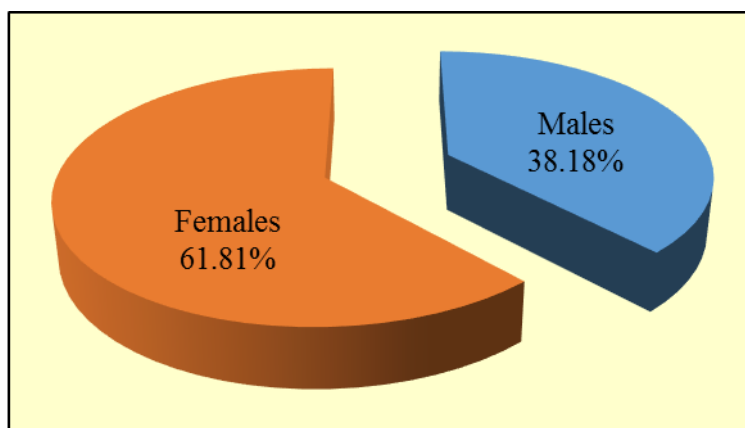
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Figure No. 1: Percentage Gender Distribution

Based on Age

Table 2 and figure 2 shows the age wise distribution of prescriptions. Out of 110 patients included for the study, 1 (0.90%) patients had an age 30-34, 1 (0.90%) patients had an age 35-39, 3 (2.72%)patients had an age 40-44, 9(8.18%)patients had an age 45-49, 7(6.36%) patients had an age 50-54, 12(10.90%) patients had an age 55-59, 24(21.81%) patients had an age 60-64 , 20(18.18%) patients had an age 65-69,18(16.36%) patients had an age 70-74,11(9.08%) patients had an age 75-79, 5(4.54%) patients had an age 80-84.

Table No. 2: Age Wise Distribution of Prescriptions

Sl. No.	Age	No. of patients (n=110)	Percentage (%)
1	30-34years	1	0.90%
2	35-39years	1	0.90%
3	40-44years	3	2.72%
4	45-49years	9	8.18%
5	50-54years	7	6.36%
6	55-59years	12	10.90%
7	**60-64years**	**24**	**21.81%**
8	65-69years	20	18.18%
9	70-74 years	18	16.36%
10	75-79years	10	9.09%
11	80-84 years	5	4.54%

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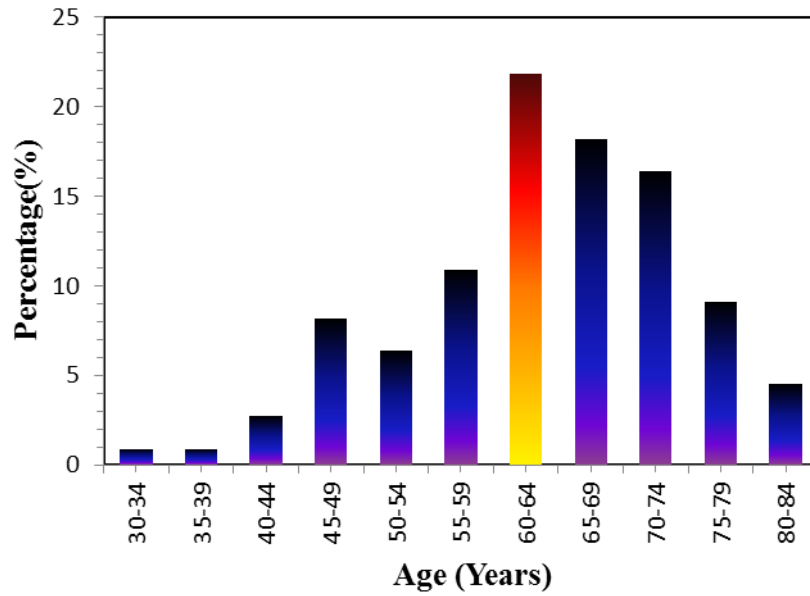
Figure No. 2: Percentage Age Wise Distribution

Based on Family History

In the present study, 110 patients participated and it was recorded that 59.09% of participants had a family history of diabetes.

Figure No. 3: Percentage distribution of Family History

Based on Duration of Diabetes Mellitus

The majority of patients 55 (50%) having the diabetic duration of 1-10 years, 33 (30%) patients having 11-20 years, 19 (17.2%) patients have 21-30 years and 3 (2.72%) patients have greater than 30 years.

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Table No. 3: Based on Duration of Diabetes Mellitus

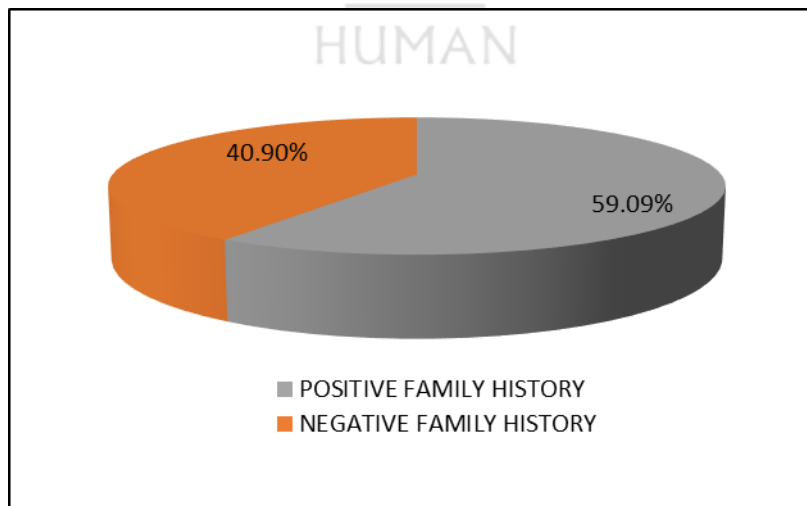| Sl. No.	Duration of DM (years)	Number of patients (N=110)	Percentage (%)
1	**1-10**	**55**	**50**
2	11-20	33	30
3	21-30	19	17.2
4	>30	3	2.72

Based on Comorbidities

Out of 110 patients, diabetes was associated with hypertension(36%), DLP (27.5%), CAD (14.22%), Thyroid (11.11%), Gout (2.6%), Neuro (1.77%), COPD (1.77%), Arthritis (2.22%), Asthma (1.33%), UTI (0.88%), CLD(0.44%)

Table No. 4: Based on Comorbidities

Sl. No.	Disease	Number of patients (n=110)	Percentage (%)
1	**HTN**	**81**	**36**
2	DLP	62	27.55
3	CAD	32	14.22
4	THYROID	25	11.11
5	GOUT	6	2.66
6	NEURO	4	1.77
7	COPD	4	1.77
8	ARTHRITIS	5	2.22
9	ASTHMA	3	1.33
10	UTI	2	0.88
11	CLD	1	0.44

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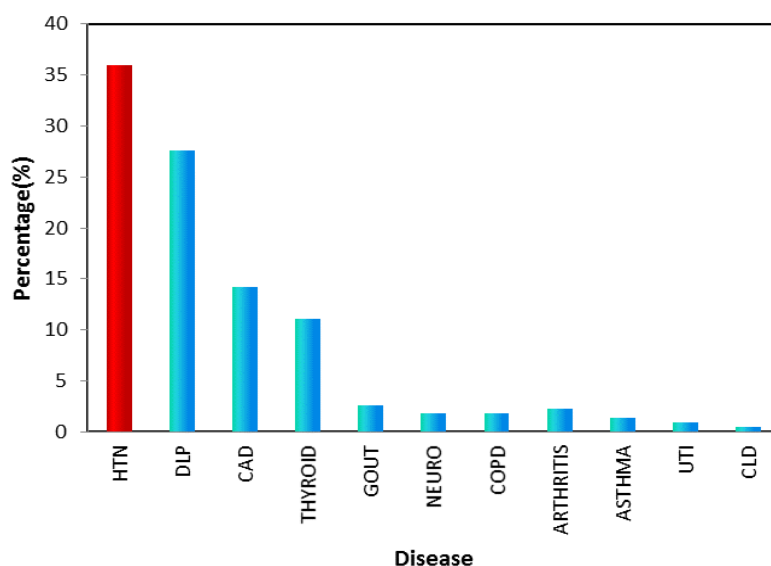
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Figure No. 4: Percentage Distribution of Comorbidities

Pattern of Anti-Diabetic Drugs Prescribed

Among the various anti-diabetics prescribed, insulin were the most common class of drugs accounting for 71 (35.32%) of the total anti-diabetics followed by biguanides 35 (17.41%), alpha glycosidase inhibitors 34 (16.91%), DDP-4 Inhibitors 27(13.43%) thiazolidinedione's 3 (1.49%), Meglitinides 2 (0.99%) and SGLT2 Inhibitors 2 (0.99%).

Table No. 5: Prescription pattern on anti-diabetic drugs.

Sl. No.	Drug class	Name of the drug	Number of times prescribed (%)
1	Insulin	Insulin	71 (35.32%)
2	Biguanides	Metformin	35 (17.41%)
3	Alpha glucosidase inhibitor	Voglibose	30 (14.92%)
		Acarbose	3 (1.49%)
		Miglitol	1 (0.49%)
4	Sulphonylurea	Glimepiride	18 (8.95)
		Gliclazide	10 (4.97%)
5	DDP4 Inhibitors	Teneligliptin	15 (7.46%)
		Vildagliptin	7 (3.48%)
		Sitagliptin	4 (1.99%)
		Saxagliptin	1 (0.49%)
6	Thiazolidinediones	Pioglitazone	3 (1.49%)
7	Meglitinides	Repaglinide	1 (0.49%)
8	SGLT2 Inhibitors	Dapagliflozin	1 (0.49%)
		Canagliflozin	1 (0.49%)

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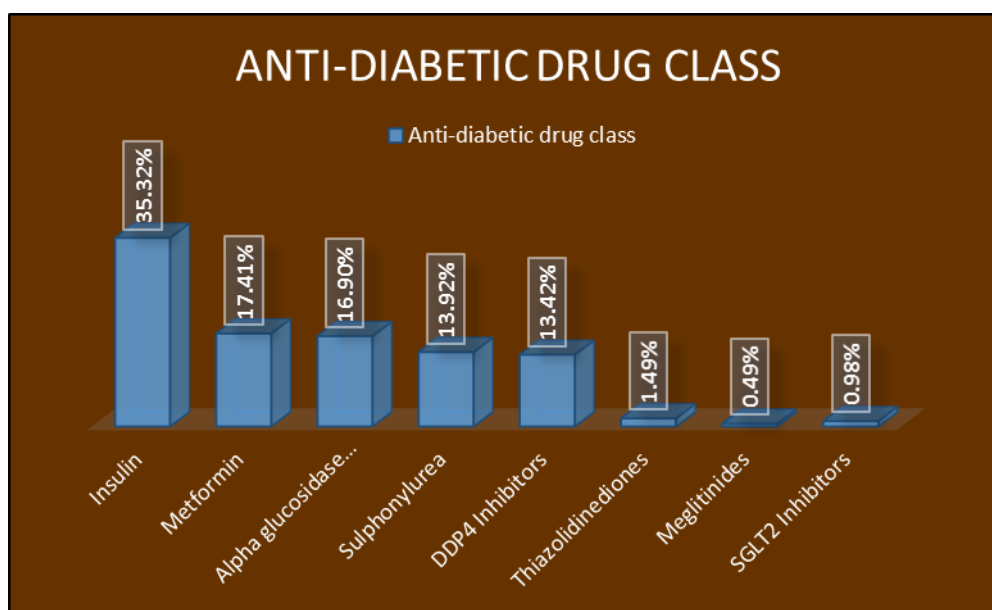
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Figure No. 5: Percentage distribution of classes of Anti-diabetic drugs prescribed

Considering the combination of anti-diabetic drugs prescribed in our study populations, most of the patients were prescribed metformin and glimepiride combination (57.14%) followed by metformin and sitagliptin combinations (15.58%). There were six patients who received triple-drug combination consisting of Glimepiride, Metformin, and pioglitazone and Glimepiride, Metformin and Voglibose.

Table No. 6: Distribution of anti-diabetic drug combinations

Sl. No.	Combinations	Number of times prescribed (%)
1	**Glimepiride + Metformin**	**44 (57.14%)**
2	Sitagliptin + Metformin	12 (15.58%)
3	Glibenclamide + Metformin	7 (9.09%)
4	Vildagliptin + Metformin	4 (5.19%)
5	Gliclazide + Metformin	3 (3.89%)
6	Miglitol + Metformin	1 (1.29%)
7	Glimepiride + Metformin + Voglibose	3 (3.89%)
8	Glimepiride + Metformin + Pioglitazone	3 (3.89%)

The frequently prescribed insulin was intermediate acting, followed by rapid acting, short acting and least prescribed was with long acting.

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Table No. 7: Frequency of insulin prescribed

Sl. No.	Type of insulin	Number of prescriptions	Percentage (%)
1	**Intermediate-acting**	**44**	**61.97%**
2	Rapid-acting	21	29.57%
3	Short-acting	5	7.03%
4	Long-acting	1	1.40%

Based on Polypharmacy

Among 110 patients, 20 patients were having 1-3 drugs, 46 patients have 4-6 drugs, 32 patients having 7-9 drugs, 9 patients have 10-12 drugs and 3 patients have more than 12 drugs.

Table No. 8: Distribution based on polypharmacy

SL. No.	No: of drugs per prescription	Frequency	Percentage (%)
1	1-3	20	18.18
2	**4-6**	**46**	**41.81**
3	7-9	32	29.09
4	10-12	9	8.18
5	>12	3	2.72

Prescription Pattern In Elderly

Based on Beers Criteria

Based on beers criteria drugs were classified into group 1, group 2 and group 3. Group 1 contain potentially inappropriate medication use in older adults and in group 2 the drugs that exacerbate disease condition. Group 3 include drugs to be used with caution.

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Table No. 9: Categorization of drugs among elderly based on beer's criteria

Group 1	Group 2	Group 3
Gabapentin	Cilostazol	Mirtazapine
Nortriptyline	Diltiazem	Duloxetine
	Tolterodine	Aspirin

6.14.2 Drugs Used in Elderly

Drugs used in elderly were classified, total 372 drugs were prescribed in which endocrinal drugs were high 166 (44.62%) followed by cardiovascular drugs 79 (20.69%),vitamins and minerals 38 (9.6),central nervous system drugs 25 (6.1%), hypolipidemic drugs 21 (5.1), antimicrobials agents 17 (4.03%), gastrointestinal drugs 14 (3.76%), respiratory drugs 07 (1.8%), analgesics and antibiotics 03 (0.80%), haematological drugs 02 (0.53%).

Table No. 10: Prescription pattern among elderly

Sl No.	Drug category	Number of drugs	Percentage (%)
1	Endocrinal	166	44.62
2	Cardiovascular	79	20.69
3	Vitamins and minerals	38	9.6
4	Central nervous system	25	6.1
5	Hypolipidemic	21	5.1
6	Anti-microbials	17	4.03
7	Gastrointestinal	14	3.76
8	Respiratory	07	1.8
9	Analgesics and anti-inflammatory	03	0.80
10	Hematological	02	0.53
	TOTAL	372	100

DISCUSSION

A prospective observational study was carried out in 110 patients in a tertiary care hospital for a period of six months in order to identify potentially inappropriate medications using Beers Criteria in addition age, gender, family history, duration of diabetes, comorbidity, pattern of antidiabetic drug prescribed, combination of drugs used, insulin prescribed, poly

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pharmacy and prescription pattern in elderly patients were associated with PIM (potentially inappropriate medication use).

The data were collected from the patients using specially designed data collection form in which 42(38.18%) were male and 68(61.81%) were females which is similar to the study *Thushara.c et al.,* Patients in the age group of 60-64 having more incidence of diabetic mellitus than other age groups, this incidence is more observed in the study conducted by *Sahil Sha et al.,.[7-8]*About half of the patients having positive family history 65(59.09%) and 45(40.90%) participant had a negative family history of diabetes. Majority of the patients 55(50%) having the diabetic history of 1-10 years wherein *Rajiv Singala et al.,* and other studies show that the average duration of diabetic history was 20 years. In this study hypertension was the most common comorbid condition followed by hyperlipidemia and chronic artery disease.

While assessing the prescription pattern of anti diabetic drugs in our study shows that insulin was the most preferred treatment for managing diabetic mellitus in adults and it shows similar in *Amandeep Singh et al.,*.Metformin was the most commonly used oral hypoglycemic agent which is similar to other studies like *Mariyam Unnisa et al.,* and *Tushara.C et al..*In combination therapy, two drug regimen glimepiride + metformin was highly prescribed and miglitol+metformin least prescribed.[9] Three drug combinations were used in restricted number of cases. Only 15 participants are prescribed with newer drugs. That is vildagliptin was the most commonly prescribed one. Drugs used in elderly patients were classified, total 372 drugs were prescribed in which endocrinal drugs were high 166(44.62) followed by cardiovascular drugs 79(20.69%), vitamins and mineral 38(9.6%).

Medications can result in more severe adverse events among older adults, and the Beers Criteria have helped define those drugs that are best avoided in this population. The Beers Criteria are intended to improve medication selection, reduce adverse drug events, and provide a tool to assess cost, patterns, and quality of care of drugs used for people aged 65 years or older. It lists drugs that should be avoided in the treatment of older adults, either generally or in patients with specific diseases or conditions. Based on beers criteria drugs were classified into three groups. Group 1contains potentially inappropriate medication use, Group2 includes drugs that exacerbate the disease condition and group 3 is the drugs to be used with caution.

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In this study gabapentin and nortriptyline are the drug comes under group 1Gabapentin and nortriptyline are given with the patients who have a previous history of ataxia to treat the neuropathic pain. But as per the Beers recommendation, it should be avoided in patients with a history of falls or fractures due to its ability to produce ataxia, syncope, and additional falls. The strength of recommendation is strong and quality of evidence is high in beers criteria. Other patients were prescribed with nortriptyline who having the previous history of ataxia. According to beers criteria it should be avoided in patients with a history of falls or fracture due to its ability to produce ataxia, impaired psychomotor function, syncope, and additional falls.

The drugs, which exacerbate the existing conditions are included in group 2 three drugs were found during our study are cilostazol, tolterodine, and diltiazem. Cilostazol was prescribed to the patients for the treatment intermittent claudication but the patients had the history of myocardial infarction. According to beers criteria, it is contraindicated to the patients with heart failure. It may promote fluid retention and exacerbate the heart failure condition. Another patient was prescribed with tolterodine to treat urinary incontinence. But based on beers criteria it is not prescribed to a patient with delirium, dementia, and other cognitive impairment may worsen the present condition. In our case, the patient has the previous history of Parkinsonism so it is contraindicated. Diltiazem was prescribed for the treatment of hypertension but as per beers recommendation, it should be avoided in the patients with heart failure because the patients had the complaints of heart failure.

In group 3 which are used with caution in elderly patients, the drugs are aspirin, duloxetine, and mirtazapine. Aspirin is used with caution in elderly patients >/80 yrs old which shows similar in study *Senthilvel et al.,*.Mirtazapine and duloxetine may exacerbate or cause hyponatremia in elderly patients.

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